NISTTech

DIMENSIONAL REFERENCE FOR TOMOGRAPHY

Inexpensive dimensional reference phantom for medical CT and MRI

Description

This invention is an inexpensive dimensional reference phantom for medical Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). CT and MRI scans provide anatomical images of the body that can be used to measure a patient's response to cancer therapy by measuring changes in tumor size. The NIST phantom reduces measurement errors due to variations in the observation conditions.

For CT imaging, the NIST phantom consists of a set of 3 spheres for 2D (a 1D version requires 2 spheres; a 3D version requires 4 spheres) spaced by precise plastic spacers. The sizing reference phantom is placed adjacent to a patient during scanning. The Difference between the centroids of the spheres gives an accurate scale of length permitting a precise determination of tumor size.

For MRI, the NIST phantom serves as a dimensional reference using either "positive space" or "negative space." In either case, several spheres are spaced by known distances and the centroids of the spheres are found. The "positive space" implementation is a direct adaptation of the previous CT invention described above. For the "negative space" implementations, a structure with well-defined definitions is placed in a box of water. To enhance contrast, an appropriate contrast-enhancing agent such as the chelate diethylenetraminepentacetic acid (DTPA) with Gd3+ is added.

Images

Device used to correctly scale CT and MRI images

Applications

- **Cancer treatment**
  Allows doctors to know the precise size of tumors
- **CT and MRI's**
  Scales objects (tumors or growths) in 1D, 2D, and 3D CT and MRI images

Advantages

- **Reduced Errors**
  Maintains an accurate size of a tumor even if the images are taken at different scales
- **Inexpensive**
  Affordable and reusable
- **Simple**
  Extremely simple to use, just place beside the patient during the scan
- **Compact**
  The Phantom is roughly 3.5 cm long

Abstract

A dimensional reference system for tomography, including X-ray computed tomography and MRI tomography. The system includes a dimensional reference apparatus that comprises plurality of spheres composed of a material having an X-ray absorption property between approximately +500 Hounsfield units and +1200 Hounsfield units. The spheres are spaced apart at a known distance by support structure/spacer unit that has an X-ray absorption property between approximately -100

Hounsfield units and +400 Hounsfield units. After an image that incorporates the dimensional reference apparatus and a measurement subject has been reconstructed, the dimensional reference apparatus provides for measurement of the resultant image voxels in three dimensions. Because solid structural elements such as plastic or glass spheres may not be visible in an MRI, an MRI implementation of the apparatus may be disposed in a fluid-tight enclosure along with water, a contrast-enhancing agent and ethanol.

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Citations

1. Z.H. Levine; S. Grantham, A.P. Reeves, D.S. Sawyer, D.F. Yankelevitz. A low-cost fiducial reference phantom for computed tomography. Journal of Research of the National Institute of Standards and Technology. Nov-Dec 2008.

References

- US Patent #7,967,507 issued 08/27/2009, expires 06/13/2029
- Docket: 07-023/029

Status of Availability

This invention is available for licensing exclusively or non-exclusively in any field of use.

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